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PRELIMINARY ANALYSIS OF NUTRIENT MONITORING DATA FOR THE SUSQUEHANNA RIVER AND SELECTED TRIBUTARIES JANUARY 1, 1985 – DECEMBER 31, 1987

SUSQUEHANNA RIVER BASIN COMMISSION

RESOURCE QUALITY MANAGEMENT & PROTECTION DIVISION

APRIL 1988

The Susquehanna River Basin Commission was created as an independent agency by a Federal-Interstate Compact* among the States of Maryland, New York, Commonwealth of Pennsylvania and the Federal Government. In creating the Commission, the Congress and State Legislatures formally recognized the water resources of the Susquehanna River basin as a regional asset vested with local, State and National interests for which all the parties share responsibility. As the single Federal-Interstate water resources agency with basinwide authority, the Commission's goal is to effect coordinated planning, conservation, management, utilization, development and control of basin water resources among the government and private sectors.

SUSQUEHANNA RIVER BASIN COMMISSION

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* Statutory Citations: Federal - Pub. L. 91-575, 84 Stat. 1509 (December, 1970); Maryland - Natural Resources §8-301 (Michie 1974); New York - ECL §21-1301 (McKinney 1973); and Pennsylvania - 32 P.S. 820.1 (Supp. 1976).

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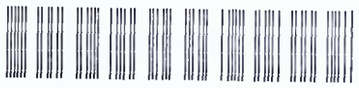

SUSQUEHANNA RIVER BASIN COMMISSION
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NOTICE

The following report is based on a preliminary analysis of data collected during the first two years of a five-year data collection program. The conclusions of this report are therefore subject to change after completion of the entire five-year program and a thorough analysis of all data.

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INTRODUCTION

The 1987 Chesapeake Bay Agreement states that "the improvement and maintenance of water quality is the single most critical element in the overall restoration and protection of the bay." Improvement in water quality includes "the reduction of nutrients from both point and nonpoint sources." Agreement was reached to set a goal for achieving a 40% reduction in nutrients entering the bay system by the year 2000. Data that is useful in developing a plan to achieve that goal has been and is being collected for the Chesapeake Bay Program by a joint program directed by the Susquehanna River Basin Commission.

The objective of this joint Susquehanna River Basin Commission (SRBC)/Pennsylvania Department of Environmental Resources (PaDER), Bureau of Soil & Water Conservation and Bureau of Laboratories/U.S. Geological Survey (USGS) program is to collect, collate, analyze and disseminate nutrient data for the Susquehanna River and selected tributaries. This program establishes a sound database which can be used to effectively plan and implement both immediate and long-range nutrient reduction efforts and support modeling activities.

These data were also used to estimate the nutrient loads for this report.

SAMPLE COLLECTION AND ANALYSIS

Sample collection began at twelve sites in the Susquehanna River basin in October, 1984. A listing of the sampling sites and their location is on the following page. Yearly sampling consists of collecting twelve monthly baseflow samples as well as storm samples during each of the four seasons. Storm coverage includes sample collection on both the rising and falling stream stage.

The depth-integrated, multivertical, composited samples are brought to the PaDER lab usually within 24 hours of collection. Nitrite plus nitrate -N and ammonia -N are normally analyzed within 24 hours of receipt of samples. Only EPA approved methods of chemical analyses are used by the PaDER lab for the programs samples.

Chemical constituents analyzed include:

nitrite + nitrate - N, total

ammonia - N, total

Kjeldahl N, total and dissolved

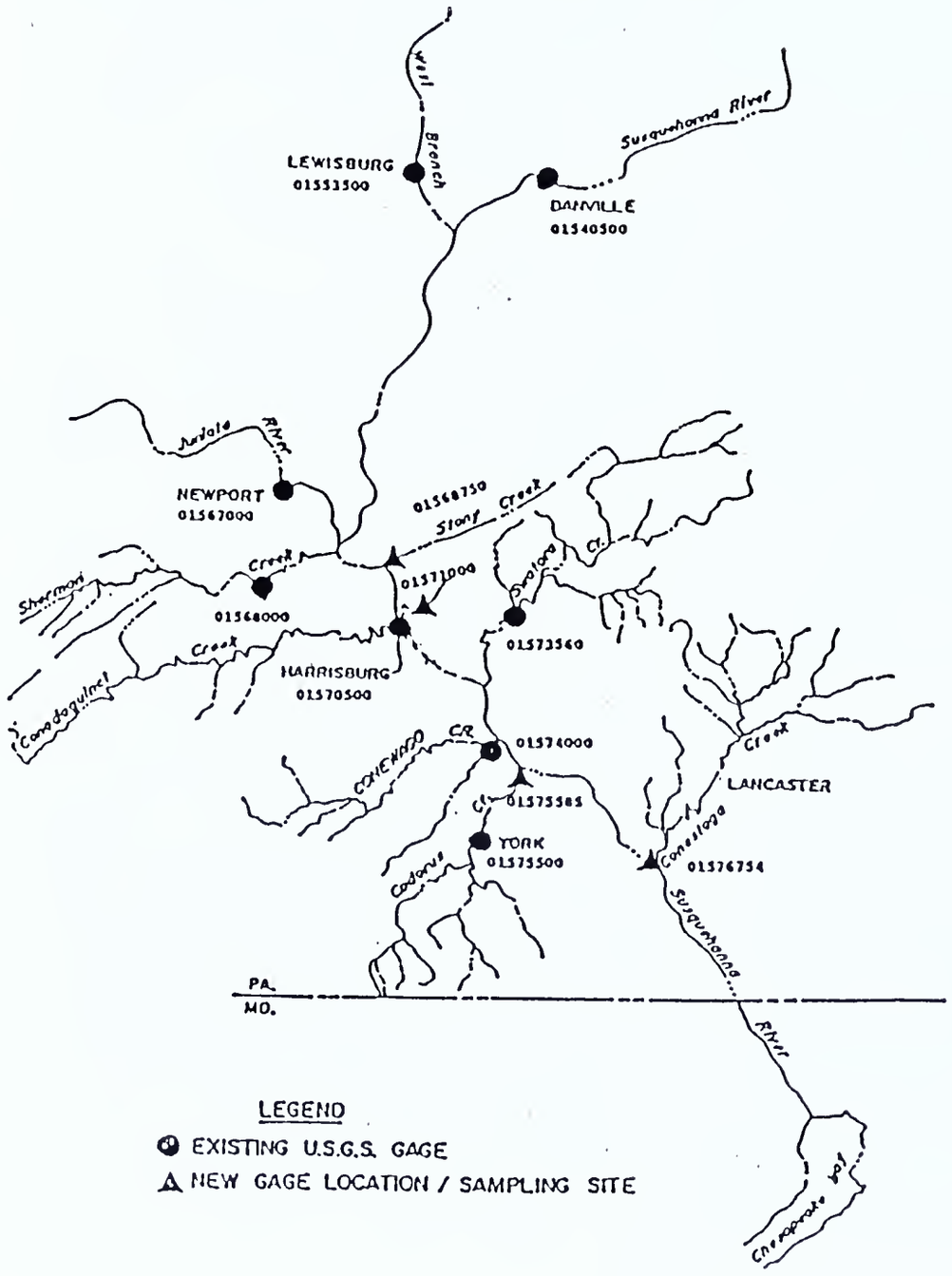
Phosphorus, total and dissolved

Orthophosphate - P, dissolved

Organic carbon, total

Concentrations of suspended sediment are determined for all samples at the USGS sediment laboratory.

SECTION OF SUSQUEHANNA RIVER BASIN SHOWING LOCATIONS OF NUTRIENT MONITORING SITES



Site Number	Sampling Site	Drainage Area (Sq Miles)
01540500	Susquehanna River @ Danville	11,220
01553500	W. Branch Susquehanna River @ Lewisburg	6,847
01567000	Juniata River @ Newport	3,354
01568000	Sherman Creek @ Shermans Dale	200
01568750	Stony Creek Nr Dauphin	21.9
01570500	Susquehanna River @ Harrisburg	24,100
01571000	Paxton Creek Nr Penbrook	11.2
01573560	Swatara Creek Nr Hershey	483
01574000	W. Conewago Creek Nr Manchester	510
01575500	Codorus Creek Nr York	222
01575585	Codorus Creek @ Pleasureville	267
01576754	Conestoga River @ Conestoga	470

The data collected under this program were used to estimate the nutrient loads for the entire Susquehanna River Basin as well as at the 12 sites within the basin for Calendar Years 1985 and 1986.

The annual nutrient load for the Susquehanna River Basin are shown in the table below.

ANNUAL NUTRIENT LOADS FOR THE SUSQUEHANNA RIVER BASIN

	CY-1985 (Tons)	CY-1986 (Tons)
Organic Nitrogen	17,215	28,548
Inorganic Nitrogen	47,190	55,740
Total Nitrogen	64,405	84,827
Total Phosphorus	1,992*	4,598
Suspended Sediment	776,017*	3,626,683
Dissolved Phosphorus	1,197	1,711
Total Nitrite plus Nitrate Nitrogen	45,123	52,825
Total Ammonia as Nitrogen	2,066	2,915
Dissolved Kjeldahl Nitrogen	13,742	20,298
Total Kjeldahl Nitrogen	20,611	33,210
Total Organic Carbon	103,043	162,800

* Results questionable.

Annual nutrient loads fluctuated from CY-1985 to CY-1986. CY-1985 annual loads were computed using primarily baseflow data while CY-1986 data included a number of storms. This mirrors the difference in runoff between the two years. The lower runoff for 1985 is reflected by the fact that the average discharge per square mile was generally about 1 cfsm while, except for Codorus Creek, the average in 1986 was nearly 1.5 cfsm. Peak discharges were also generally lower in 1985 than in 1986. Discharge for CY-1986 was slightly above average based on data for the USGS

gage at Marrietta, PA. The average discharge for 1986 was 38,280 cfs. compared to the 55-year average of 36,900 cfs. Also, Williams and Reed (1972) reported that under average runoff conditions, the Susquehanna River transports about 3 million tons of sediment annually. Approximately 3.6 million tons of sediment were estimated to have been transported in 1986.

PERCENTAGE OF BASIN ANNUAL NUTRIENT LOAD
ORIGINATING UPSTREAM OF HARRISBURG

	CY-1985	CY-1986
Organic Nitrogen	79	83
Inorganic Nitrogen	83	77
Total Nitrogen	82	78
Total Phosphorus	42	78
Suspended Sediment	41	86
Dissolved Phosphorus	59	69
Total Nitrite plus Nitrate Nitrogen	83	77
Total Ammonia as Nitrogen	68	70
Dissolved Kjeldahl Nitrogen	82	82
Total Kjeldahl Nitrogen	73	78
Total Organic Carbon	78	80

Drainage area above Harrisburg = 88% of entire Susquehanna River basin

With the exception of suspended sediment and phosphorus for the CY-1985, above table shows the the percentage of annual loads originating upstream of Harrisburg corresponded fairly well with the percentage of drainage area upstream of Harrisburg. It was previously pointed out that flows in CY-1985 were low. Low flow, particularly on the Main Stem, results in low stream velocities, velocities probably not high enough to transport sediment. This probably resulted in channel storage of sediment in the Main Stem above Harrisburg. This would also be reflected in phosphorus

which has a high affinity for sediment. This stored material will be available to be scoured during higher flow years causing much higher loadings than that being transported by overland runoff.

PERCENTAGE OF ANNUAL NUTRIENT LOAD THAT ORIGINATES UPSTREAM OF DANVILLE & LEWISBURG

	CY-1985	
	Danville	Lewisburg
Organic Nitrogen	68	32
Inorganic Nitrogen	63	37
Total Nitrogen	65	35
Total Phosphorus	75	25
Suspended Sediment	71	29
Dissolved Phosphorus	73	27
Total Nitrite plus Nitrate Nitrogen	66	34
Total Ammonia as Nitrogen	67	33
Dissolved Kjeldahl Nitrogen	70	30
Total Kjeldahl Nitrogen	64	36
Total Organic Carbon	68	32

	CY-1986	
	Danville	Lewisburg
Organic Nitrogen	67	33
Inorganic Nitrogen	63	37
Total Nitrogen	65	35
Total Phosphorus	75	25
Suspended Sediment	79	21
Dissolved Phosphorus	63	37
Total Nitrite plus Nitrate Nitrogen	63	37
Total Ammonia as Nitrogen	70	30
Dissolved Kjeldahl Nitrogen	68	32
Total Kjeldahl Nitrogen	66	34
Total Organic Carbon	74	26

Percentage Drainage Areas = Danville 62 Lewisburg 38

The data in the above table indicate that the loads, based on being proportional to the drainage area, correspond very well. In most instances, except for the underlined data for phosphorus, suspended sediment, and TOC, the loads were generally within $\pm$10% of the drainage area. It appears that in both flow regimes phosphorus was disproportionately higher in the Main Stem Susquehanna River than in the W. Branch Susquehanna River.

An effort has been made to establish that CY-1985 was a relatively dry year and, therefore, should be a low load producing year. An anomaly to this perception is Codorus Creek. The following table is a compilation of load data for Codorus Creek at Pleasureville.

ANNUAL LOAD IN TONS

YEAR	ON	IN	TN	TP	SS	CFSM	PEAK CFS
1985	340	680	1,020	100	55,300	0.92	6,600
1986	430	770	1,200	70	33,400	0.94	2,030

As seen from the table, inorganic and total nitrogen (IN, TN) values are higher for 1986 than for 1985, yet total phosphorus and suspended sediment (TP, SS) are lower. This apparent anomaly can be explained by the stream discharge. While the average discharge was slightly lower in 1985 than in 1986, the peak discharge was three times greater. The significance of this high peak flow in 1985 is that in four days it carried 44,400 tons or

80% of the annual sediment load while carrying only 53 tons or 10% of the annual IN load during the same time period.

BASIS FOR LOAD COMPUTATIONS

Constituent loads were estimated using techniques described by Miller (1951). The load estimates were derived by combining daily load data obtained from the transport curve with streamflow data taken from a flow duration curve.

The transport curve was obtained by converting the instantaneous constituent concentration in mg/L into tons per day or pounds per day using the equation:

$$L = C\ Q\ F$$

where

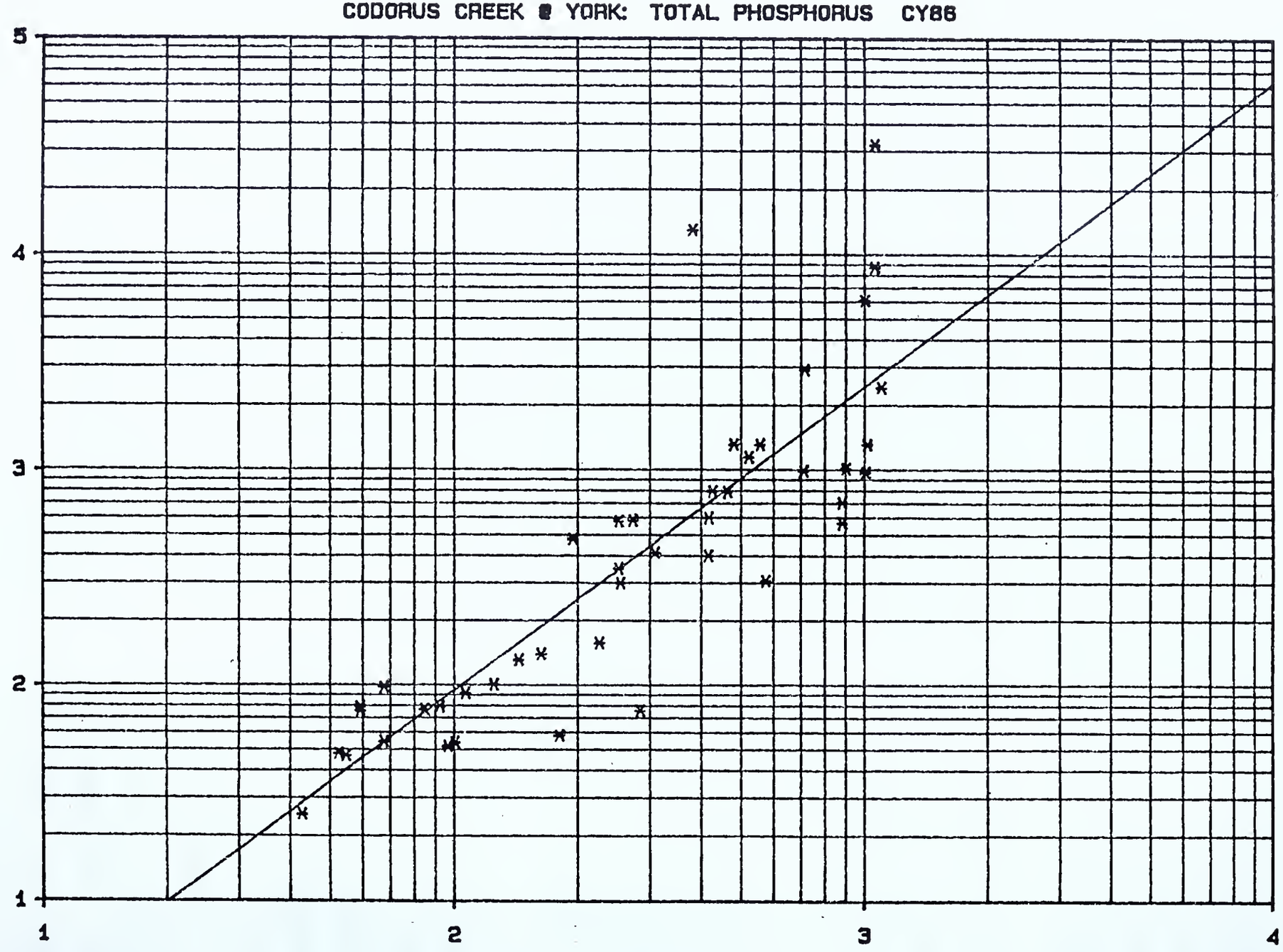
L = constituent load in tons per day or pounds per day

C = constituent concentration in milligrams per liter

Q = instantaneous stream discharge in cubic feet per second

F = 0.0027 for tons per day; 5.39 for pounds per day

Constituent loads were plotted against instantaneous water discharge on logarithmic paper (for example, see next page). Linear regression analysis were performed on the logarithmic transformations to determine the relation between load and streamflow. Transport curves were fitted by the method of least squares. The T test was performed to test the slope for significant difference from zero at the 95 percent confidence interval. Regression equations and correlation coefficients (r) are listed with each transport curve.



X-axis: Discharge in cfs
Y-axis: Load in lbs/day
-CY86: LOG(Y) = -0.849 + 1.411*LOG(X)

The flow duration curve is a cumulative frequency curve that shows the percent of time specified discharges were equalled or exceeded during a given period (Searcy, 1959).

Fishel (1984) calculated nutrient loads carried by the Susquehanna River at Harrisburg using three different methods, one of which was used in this report. Differences in results were usually less than 5% between the three methods.

The annual nutrient loads for the basin were obtained by adding the loads together for Susquehanna River at Harrisburg, Paxton Creek, Swatara Creek, W. Conewago Creek, Codorus Creek, and the Conestoga River, plus the estimated loads for the 860 square miles below Harrisburg that were not monitored.

APPENDIX

COMPUTED LOADS FOR CALENDAR YEARS 1985 AND 1986

CALENDAR YEAR 1985

STATION	ORGANIC NITROGEN		INORGANIC NITROGEN	
	ANNUAL LOAD (tons)	ANNUAL YIELD (lb/acre)	ANNUAL LOAD (tons)	ANNUAL YIELD (lb/acre)
Susquehanna River @ Danville	5889	1.64	12042	3.35
W. Br. Susquehanna @ Lewisburg	3333	1.52	6222	2.84
Juniata River @ Newport	2759	2.57	5731	5.34
Sherman Creek @ Shermans Dale	174	2.72	274	4.27
Stony Creek Nr Dauphin	9.7	1.38	3.9	0.56
Susquehanna River @ Harrisburg	13576	1.76	38970	5.05
Paxton Creek Nr Penbrook	10.2	2.85	6.7	1.87
Swatara Creek Nr Hershey	479	3.10	1207	7.81
Conewago Creek Nr Manchester	585	3.59	702	4.30
Codorus Creek Nr York	254	3.58	458	6.45
Codorus Creek @ Pleasureville	340	3.97	678	7.94
Conestoga River @ Conestoga	860	5.63	2692	17.64

STATION	TOTAL NITROGEN		TOTAL PHOSPHORUS	
	ANNUAL LOAD (tons)	ANNUAL YIELD (lb/acre)	ANNUAL LOAD (tons)	ANNUAL YIELD (lb/acre)
Susquehanna River @ Danville	17931	4.99	675	0.19
W. Br. Susquehanna @ Lewisburg	9556	4.36	230	0.10
Juniata River @ Newport	8490	7.91	183	0.17
Sherman Creek @ Shermans Dale	448	6.99	23	0.36
Stony Creek Nr Dauphin	13.6	1.94	0.7	0.10
Susquehanna River @ Harrisburg	52546	6.81	840	0.11
Paxton Creek Nr Penbrook	16.9	4.72	0.9	0.26
Swatara Creek Nr Hershey	1686	10.91	60	0.39
Conewago Creek Nr Manchester	1287	7.89	166	1.01
Codorus Creek Nr York	712	10.02	62	0.87
Codorus Creek @ Pleasureville	1018	11.91	97	1.13
Conestoga River @ Conestoga	3552	23.27	411	2.69

CALENDAR YEAR 1986

STATION	ORGANIC NITROGEN		INORGANIC NITROGEN	
	ANNUAL LOAD (tons)	ANNUAL YIELD (lb/acre)	ANNUAL LOAD (tons)	ANNUAL YIELD (lb/acre)
Susquehanna River @ Danville	12426	3.46	15598	4.34
W. Br. Susquehanna @ Lewisburg	5992	2.73	9034	4.12
Juniata River @ Newport				
Sherman Creek @ Shermans Dale	153	2.39	385	6.02
Stony Creek Nr Dauphin	27.0	3.85	5.2	0.75
Susquehanna River @ Harrisburg	23804	3.09	42656	5.53
Paxton Creek Nr Penbrook	17.1	4.78	14.2	3.97
Swatara Creek Nr Hershey	741	4.79	2296	14.86
Conewago Creek Nr Manchester	699	4.29	1246	7.63
Codorus Creek Nr York	245	3.45	519	7.30
Codorus Creek @ Pleasureville	430	5.04	772	9.03
Conestoga River @ Conestoga	1147	7.53	4251	27.85

STATION	TOTAL NITROGEN		TOTAL PHOSPHORUS	
	ANNUAL LOAD (tons)	ANNUAL YIELD (lb/acre)	ANNUAL LOAD (tons)	ANNUAL YIELD (lb/acre)
Susquehanna River @ Danville	28024	7.81	2191	0.61
W. Br. Susquehanna @ Lewisburg	15027	6.86	716	0.33
Juniata River @ Newport				
Sherman Creek @ Shermans Dale	538	8.40	21	0.33
Stony Creek Nr Dauphin	32.2	4.59	1.6	0.23
Susquehanna River @ Harrisburg	66460	8.62	3591	0.47
Paxton Creek Nr Penbrook	31.4	8.75	3.6	1.00
Swatara Creek Nr Hershey	3037	19.65	108	0.70
Conewago Creek Nr Manchester	1945	11.92	159	0.98
Codorus Creek Nr York	764	10.75	47	0.67
Codorus Creek @ Pleasureville	1202	14.07	69	0.81
Conestoga River @ Conestoga	5397	35.36	309	2.03

SUSPENDED SEDIMENT

CALENDAR YEAR 1985

STATION	ANNUAL LOAD (tons)	ANNUAL YIELD (tons/sq mi)	ANNUAL YIELD (lbs/acre)	WATER DISCHARGE (cfsm)	FLOW ADJUSTED MEAN CONCENTRATION (mg/l)
Susquehanna River @ Danville	156430	13.94	43.57	1.00	13.74
W. Br. Susquehanna @ Lewisburg	64447	9.41	29.41	1.42	6.53
Juniata River @ Newport	45458	13.55	42.35	1.16	11.42
Sherman Creek @ Shermans Dale	9247	46.24	144.49	1.07	42.59
Stony Creek Nr Dauphin	150.9	6.89	21.53	1.13	6.01
Susquehanna River @ Harrisburg	320889	13.31	41.61	1.09	12.04
Paxton Creek Nr Penbrook	2894.2	258.41	807.53	0.74	344.14
Swatara Creek Nr Hershey	28821	59.67	186.47	0.92	63.92
Conewago Creek Nr Manchester	78311	153.55	479.85	0.83	182.32
Codorus Creek Nr York	42449	191.21	597.54	0.79	238.53
Codorus Creek @ Pleasureville	55263	206.98	646.80	0.92	219.33
Conestoga River @ Conestoga	110348	231.34	722.93	0.91	250.53

CALENDAR YEAR 1986

STATION	ANNUAL LOAD (tons)	ANNUAL YIELD (tons/sq mi)	ANNUAL YIELD (lbs/acre)	WATER DISCHARGE (cfsm)	FLOW ADJUSTED MEAN CONCENTRATION (mg/l)
Susquehanna River @ Danville	1669920	148.83	465.11	1.57	93.42
W. Br. Susquehanna @ Lewisburg	437889	63.95	199.85	1.82	34.63
Juniata River @ Newport					
Sherman Creek @ Shermans Dale	12414	62.07	193.97	1.2	50.97
Stony Creek Nr Dauphin	731.7	33.41	104.41	1.36	24.21
Susquehanna River @ Harrisburg	2762428	114.62	358.20	1.47	76.84
Paxton Creek Nr Penbrook	9538.3	851.63	2661.35	1.36	617.12
Swatara Creek Nr Hershey	134484	278.43	870.11	1.6	171.50
Conewago Creek Nr Manchester	129093	253.12	791.01	1.1	226.78
Codorus Creek Nr York	28425	128.04	400.13	0.79	159.73
Codorus Creek @ Pleasureville	33407	125.12	391.00	0.94	134.03
Conestoga River @ Conestoga	263869	553.18	1728.70	1.43	381.23

DISSOLVED PHOSPHORUS

CALENDAR YEAR 1985

STATION	ANNUAL LOAD (tons)	ANNUAL YIELD (tons/sq mi)	ANNUAL YIELD (lbs/acre)	WATER DISCHARGE (cfsm)	FLOW ADJUSTED MEAN CONCENTRATION (mg/l)
Susquehanna River @ Danville	345	0.03	0.10	1.00	0.03
W. Br. Susquehanna @ Lewisburg	125	0.02	0.06	1.42	0.01
Juniata River @ Newport	139	0.04	0.13	1.16	0.03
Sherman Creek @ Shermans Dale	8	0.04	0.13	1.07	0.04
Stony Creek Nr Dauphin	1	0.05	0.14	1.13	0.04
Susquehanna River @ Harrisburg	702	0.03	0.09	1.09	0.03
Paxton Creek Nr Penbrook	0.3	0.03	0.08	0.74	0.04
Swatara Creek Nr Hershey	20	0.04	0.13	0.92	0.04
Conewago Creek Nr Manchester	93	0.18	0.57	0.83	0.22
Codorus Creek Nr York	19	0.09	0.27	0.79	0.11
Codorus Creek @ Pleasureville	33	0.12	0.39	0.92	0.13
Conestoga River @ Conestoga	174	0.36	1.14	0.91	0.40

CALENDAR YEAR 1986

STATION	ANNUAL LOAD (tons)	ANNUAL YIELD (tons/sq mi)	ANNUAL YIELD (lbs/acre)	WATER DISCHARGE (cfsm)	FLOW ADJUSTED MEAN CONCENTRATION (mg/l)
Susquehanna River @ Danville	647	0.06	0.18	1.57	0.04
W. Br. Susquehanna @ Lewisburg	385	0.06	0.18	1.82	0.03
Juniata River @ Newport					
Sherman Creek @ Shermans Dale	10	0.05	0.15	1.2	0.04
Stony Creek Nr Dauphin	1.1	0.05	0.15	1.36	0.03
Susquehanna River @ Harrisburg	1186	0.05	0.15	1.47	0.03
Paxton Creek Nr Penbrook	0.8	0.07	0.22	1.36	0.05
Swatara Creek Nr Hershey	43	0.09	0.28	1.6	0.05
Conewago Creek Nr Manchester	97	0.19	0.59	1.1	0.17
Codorus Creek Nr York	17	0.08	0.24	0.79	0.09
Codorus Creek @ Pleasureville	34	0.13	0.40	0.94	0.14
Conestoga River @ Conestoga	167	0.35	1.10	1.43	0.24

TOTAL PHOSPHORUS

CALENDAR YEAR 1985

STATION	ANNUAL LOAD (tons)	ANNUAL YIELD (tons/sq mi)	ANNUAL YIELD (lbs/acre)	WATER DISCHARGE (cfsm)	FLOW ADJUSTED MEAN CONCENTRATION (mg/l)
Susquehanna River @ Danville	675	0.06	0.19	1.00	0.06
W. Br. Susquehanna @ Lewisburg	230	0.03	0.10	1.42	0.02
Juniata River @ Newport	183	0.05	0.17	1.16	0.05
Sherman Creek @ Shermans Dale	23	0.11	0.36	1.07	0.10
Stony Creek Nr Dauphin	0.7	0.03	0.10	1.13	0.03
Susquehanna River @ Harrisburg	840	0.03	0.11	1.09	0.03
Paxton Creek Nr Penbrook	0.9	0.08	0.26	0.74	0.11
Swatara Creek Nr Hershey	60	0.12	0.39	0.92	0.13
Conewago Creek Nr Manchester	166	0.32	1.01	0.83	0.39
Codorus Creek Nr York	62	0.28	0.87	0.79	0.35
Codorus Creek @ Pleasureville	97	0.36	1.13	0.92	0.38
Conestoga River @ Conestoga	411	0.86	2.69	0.91	0.93

CALENDAR YEAR 1986

STATION	ANNUAL LOAD (tons)	ANNUAL YIELD (tons/sq mi)	ANNUAL YIELD (lbs/acre)	WATER DISCHARGE (cfsm)	FLOW ADJUSTED MEAN CONCENTRATION (mg/l)
Susquehanna River @ Danville	2191	0.20	0.61	1.57	0.12
W. Br. Susquehanna @ Lewisburg	716	0.10	0.33	1.82	0.06
Juniata River @ Newport					
Sherman Creek @ Shermans Dale	21	0.11	0.33	1.2	0.09
Stony Creek Nr Dauphin	1.6	0.07	0.23	1.36	0.05
Susquehanna River @ Harrisburg	3591	0.15	0.47	1.47	0.10
Paxton Creek Nr Penbrook	3.6	0.32	1.00	1.36	0.23
Swatara Creek Nr Hershey	108	0.22	0.70	1.6	0.14
Conewago Creek Nr Manchester	159	0.31	0.98	1.1	0.28
Codorus Creek Nr York	47	0.21	0.67	0.79	0.27
Codorus Creek @ Pleasureville	69	0.26	0.81	0.94	0.28
Conestoga River @ Conestoga	309	0.65	2.03	1.43	0.45

TOTAL NO_2+NO_3-N

CALENDAR YEAR 1985

STATION	ANNUAL LOAD (tons)	ANNUAL YIELD (tons/sq mi)	ANNUAL YIELD (lbs/acre)	WATER DISCHARGE (cfsm)	FLOW ADJUSTED MEAN CONCENTRATION (mg/l)
Susquehanna River @ Danville	10663	0.95	2.97	1.00	0.94
W. Br. Susquehanna @ Lewisburg	5535	0.81	2.53	1.42	0.56
Juniata River @ Newport	5593	1.67	5.21	1.16	1.40
Sherman Creek @ Shermans Dale	262	1.31	4.09	1.07	1.20
Stony Creek Nr Dauphin	2.6	0.12	0.37	1.13	0.10
Susquehanna River @ Harrisburg	37569	1.56	4.87	1.09	1.41
Paxton Creek Nr Penbrook	5.9	0.52	1.64	0.74	0.70
Swatara Creek Nr Hershey	1149	2.38	7.44	0.92	2.55
Conewago Creek Nr Manchester	621	1.22	3.80	0.83	1.44
Codorus Creek Nr York	438	1.97	6.16	0.79	2.46
Codorus Creek @ Pleasureville	520	1.95	6.09	0.92	2.07
Conestoga River @ Conestoga	2562	5.37	16.78	0.91	5.82

CALENDAR YEAR 1986

STATION	ANNUAL LOAD (tons)	ANNUAL YIELD (tons/sq mi)	ANNUAL YIELD (lbs/acre)	WATER DISCHARGE (cfsm)	FLOW ADJUSTED MEAN CONCENTRATION (mg/l)
Susquehanna River @ Danville	14112	1.26	3.93	1.57	0.79
W. Br. Susquehanna @ Lewisburg	8386	1.22	3.82	1.82	0.66
Juniata River @ Newport					
Sherman Creek @ Shermans Dale	368	1.84	5.75	1.2	1.51
Stony Creek Nr Dauphin	3.8	0.17	0.54	1.36	0.13
Susquehanna River @ Harrisburg	40613	1.69	5.27	1.47	1.13
Paxton Creek Nr Penbrook	13.2	1.17	3.67	1.36	0.85
Swatara Creek Nr Hershey	2189	4.53	14.16	1.6	2.79
Conewago Creek Nr Manchester	1148	2.25	7.04	1.1	2.02
Codorus Creek Nr York	494	2.23	6.96	0.79	2.78
Codorus Creek @ Pleasureville	602	2.25	7.04	0.94	2.41
Conestoga River @ Conestoga	4062	8.51	26.61	1.43	5.87

TOTAL AMMONIA-N

CALENDAR YEAR 1985

STATION	ANNUAL LOAD (tons)	ANNUAL YIELD (tons/sq mi)	ANNUAL YIELD (lbs/acre)	WATER DISCHARGE (cfsm)	FLOW ADJUSTED MEAN CONCENTRATION (mg/l)
Susquehanna River @ Danville	1379	0.12	0.38	1.00	0.12
W. Br. Susquehanna @ Lewisburg	687	0.10	0.31	1.42	0.07
Juniata River @ Newport	287	0.09	0.27	1.16	0.07
Sherman Creek @ Shermans Dale	13	0.06	0.20	1.07	0.06
Stony Creek Nr Dauphin	1.3	0.06	0.19	1.13	0.05
Susquehanna River @ Harrisburg	1401	0.06	0.18	1.09	0.05
Paxton Creek Nr Penbrook	0.8	0.07	0.23	0.74	0.10
Swatara Creek Nr Hershey	57	0.12	0.37	0.92	0.13
Conewago Creek Nr Manchester	81	0.16	0.50	0.83	0.19
Codorus Creek Nr York	20	0.09	0.29	0.79	0.11
Codorus Creek @ Pleasureville	158	0.59	1.85	0.92	0.63
Conestoga River @ Conestoga	130	0.27	0.85	0.91	0.30

CALENDAR YEAR 1986

STATION	ANNUAL LOAD (tons)	ANNUAL YIELD (tons/sq mi)	ANNUAL YIELD (lbs/acre)	WATER DISCHARGE (cfsm)	FLOW ADJUSTED MEAN CONCENTRATION (mg/l)
Susquehanna River @ Danville	1486	0.13	0.41	1.57	0.08
W. Br. Susquehanna @ Lewisburg	648	0.09	0.30	1.82	0.05
Juniata River @ Newport					
Sherman Creek @ Shermans Dale	17	0.08	0.26	1.2	0.07
Stony Creek Nr Dauphin	1.4	0.07	0.21	1.36	0.05
Susquehanna River @ Harrisburg	2043	0.08	0.26	1.47	0.06
Paxton Creek Nr Penbrook	1.1	0.10	0.30	1.36	0.07
Swatara Creek Nr Hershey	108	0.22	0.70	1.6	0.14
Conewago Creek Nr Manchester	97	0.19	0.60	1.1	0.17
Codorus Creek Nr York	25	0.11	0.35	0.79	0.14
Codorus Creek @ Pleasureville	170	0.64	1.99	0.94	0.68
Conestoga River @ Conestoga	189	0.40	1.24	0.43	0.27

TOTAL ORGANIC NITROGEN

CALENDAR YEAR 1985

STATION	ANNUAL LOAD (tons)	ANNUAL YIELD (tons/sq mi)	ANNUAL YIELD (lbs/acre)	WATER DISCHARGE (cfsm)	FLOW ADJUSTED MEAN CONCENTRATION (mg/l)
Susquehanna River @ Danville	5889	0.52	1.64	1.00	0.52
W. Br. Susquehanna @ Lewisburg	3333	0.49	1.52	1.42	0.34
Juniata River @ Newport	2759	0.82	2.57	1.16	0.69
Sherman Creek @ Shermans Dale	174	0.87	2.72	1.07	0.80
Stony Creek Nr Dauphin	9.7	0.44	1.38	0.13	0.39
Susquehanna River @ Harrisburg	13576	0.56	1.76	1.09	0.51
Paxton Creek Nr Penbrook	10.2	0.91	2.85	0.74	1.21
Swatara Creek Nr Hershey	479	0.99	3.10	0.92	1.06
Conewago Creek Nr Manchester	585	1.15	3.59	0.83	1.36
Codorus Creek Nr York	254	1.14	3.58	0.79	1.43
Codorus Creek @ Pleasureville	340	1.27	3.97	0.92	1.35
Conestoga River @ Conestoga	860	1.80	5.63	0.91	1.95

CALENDAR YEAR 1986

STATION	ANNUAL LOAD (tons)	ANNUAL YIELD (tons/sq mi)	ANNUAL YIELD (lbs/acre)	WATER DISCHARGE (cfsm)	FLOW ADJUSTED MEAN CONCENTRATION (mg/l)
Susquehanna River @ Danville	12426	1.11	3.46	1.57	0.70
W. Br. Susquehanna @ Lewisburg	5992	0.88	2.73	1.82	0.47
Juniata River @ Newport					
Sherman Creek @ Shermans Dale	153	0.76	2.39	1.2	0.63
Stony Creek Nr Dauphin	27.0	1.23	3.85	1.36	0.89
Susquehanna River @ Harrisburg	23804	0.99	3.09	1.47	0.66
Paxton Creek Nr Penbrook	17.1	1.53	4.78	1.36	1.11
Swatara Creek Nr Hershey	741	1.53	4.79	1.6	0.94
Conewago Creek Nr Manchester	699	1.37	4.29	1.1	1.23
Codorus Creek Nr York	245	1.10	3.45	0.79	1.38
Codorus Creek @ Pleasureville	430	1.61	5.04	0.94	1.73
Conestoga River @ Conestoga	1147	2.40	7.51	1.43	1.66

TOTAL INORGANIC NITROGEN

CALENDAR YEAR 1985

STATION	ANNUAL LOAD (tons)	ANNUAL YIELD (tons/sq mi)	ANNUAL YIELD (lbs/acre)	WATER DISCHARGE (cfsm)	FLOW ADJUSTED MEAN CONCENTRATION (mg/l)
Susquehanna River @ Danville	12042	1.07	3.35	1.00	1.06
W. Br. Susquehanna @ Lewisburg	6222	0.91	2.84	1.42	0.63
Juniata River @ Newport	5877	1.71	5.34	1.16	1.44
Sherman Creek @ Shermans Dale	274	1.37	4.27	1.07	1.26
Stony Creek Nr Dauphin	3.9	0.18	0.56	1.13	0.16
Susquehanna River @ Harrisburg	38970	1.62	5.05	1.09	1.46
Paxton Creek Nr Penbrook	6.7	0.60	1.87	0.74	0.80
Swatara Creek Nr Hershey	1207	2.50	7.81	0.92	2.68
Conewago Creek Nr Manchester	702	1.38	4.30	0.83	1.63
Codorus Creek Nr York	458	2.06	6.45	0.79	2.57
Codorus Creek @ Pleasureville	678	2.54	7.94	0.92	2.69
Conestoga River @ Conestoga	2692	5.64	17.64	0.91	6.11

CALENDAR YEAR 1986

STATION	ANNUAL LOAD (tons)	ANNUAL YIELD (tons/sq mi)	ANNUAL YIELD (lbs/acre)	WATER DISCHARGE (cfsm)	FLOW ADJUSTED MEAN CONCENTRATION (mg/l)
Susquehanna River @ Danville	15598	1.39	4.34	1.57	0.87
W. Br. Susquehanna @ Lewisburg	9034	1.32	4.12	1.82	0.71
Juniata River @ Newport					
Sherman Creek @ Shermans Dale	385	1.93	6.02	1.2	1.58
Stony Creek Nr Dauphin	5.2	0.24	0.75	1.36	0.17
Susquehanna River @ Harrisburg	42656	1.77	5.53	1.47	1.19
Paxton Creek Nr Penbrook	14.2	1.27	3.97	1.36	0.92
Swatara Creek Nr Hershey	2296	4.75	14.86	1.6	2.93
Conewago Creek Nr Manchester	1246	2.44	7.63	1.1	2.19
Codorus Creek Nr York	519	2.34	7.30	0.79	2.91
Codorus Creek @ Pleasureville	772	2.89	9.03	0.94	3.10
Conestoga River @ Conestoga	4250	8.91	27.85	1.43	6.14

TOTAL ORGANIC CARBON

CALENDAR YEAR 1985

STATION	ANNUAL LOAD (tons)	ANNUAL YIELD (tons/sq mi)	ANNUAL YIELD (lbs/acre)	WATER DISCHARGE (cfsm)	FLOW ADJUSTED MEAN CONCENTRATION (mg/l)
Susquehanna River @ Danville	43551	3.88	12.13	1.00	3.83
W. Br. Susquehanna @ Lewisburg	20222	2.95	9.23	1.42	2.05
Juniata River @ Newport	12958	3.86	12.07	1.16	3.25
Sherman Creek @ Shermans Dale	1314	6.57	20.53	1.07	6.05
Stony Creek Nr Dauphin	118	5.37	16.79	1.13	4.68
Susquehanna River @ Harrisburg	80677	3.35	10.46	1.09	3.03
Paxton Creek Nr Penbrook	84.3	7.53	23.53	0.74	10.03
Swatara Creek Nr Hershey	2619	5.42	16.94	0.92	5.81
Conewago Creek Nr Manchester	3008	5.90	18.43	0.83	7.00
Codorus Creek Nr York	2911	13.11	40.98	0.79	16.36
Codorus Creek @ Pleasureville	3007	11.26	35.20	0.92	11.94
Conestoga River @ Conestoga	4290	8.99	28.10	0.91	9.74

CALENDAR YEAR 1986

STATION	ANNUAL LOAD (tons)	ANNUAL YIELD (tons/sq mi)	ANNUAL YIELD (lbs/acre)	WATER DISCHARGE (cfsm)	FLOW ADJUSTED MEAN CONCENTRATION (mg/l)
Susquehanna River @ Danville	77409	6.90	21.56	1.57	4.33
W. Br. Susquehanna @ Lewisburg	27155	3.96	12.39	1.82	2.15
Juniata River @ Newport					
Sherman Creek @ Shermans Dale	1310	6.55	20.47	1.2	5.38
Stony Creek Nr Dauphin	239.6	10.94	34.20	1.36	7.93
Susquehanna River @ Harrisburg	129450	5.37	16.79	1.47	3.60
Paxton Creek Nr Penbrook	159.4	14.24	44.49	1.36	10.32
Swatara Creek Nr Hershey	5089	10.54	32.92	1.6	6.49
Conewago Creek Nr Manchester	4422	8.67	27.09	1.1	7.77
Codorus Creek Nr York	1998	9.00	28.13	0.79	11.23
Codorus Creek @ Pleasureville	3071	11.50	35.94	0.94	12.32
Conestoga River @ Conestoga	8452	17.72	55.37	1.43	12.21